

**APPENDIX I**

**ENDANGERED SPECIES SCREENING  
STUDY AND FIELD SURVEY FOR THE  
CUMERLAND BEAN PEARLY MUSSEL**  
*(Villosa trabalis)*

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**ENDANGERED SPECIES SCREENING STUDY AND  
FIELD SURVEY FOR THE CUMBERLAND BEAN PEARLY  
MUSSEL (*Villosa trabalis*) FOR A PROPOSED RESERVOIR IN  
JACKSON COUNTY, KENTUCKY**

Prepared for:  
Mangi Environmental Group  
Falls Church, Virginia

Prepared by:  
Gary W. Libby  
James D. Kiser  
Hal D. Bryan

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## **I. INTRODUCTION**

### *A. Literature Search*

Eco-Tech, Incorporated was contracted by Mangi Environmental Group to perform a literature search identifying previous studies concerning rare species in Jackson County, Kentucky. Based on our extensive literature review and data from the Kentucky State Nature Preserves Commission (KSNPC), a state agency that maintains a large biological database with information on all reports of state and federally listed plants and animals, we have prepared a list of rare species likely to occur in the proposed reservoir sites. The list includes state and federally listed species (including former federal candidate species). We have included brief descriptions of critical habitats for each species.

### *B. Cumberland Bean Pearly Mussel Field Survey*

Eco-Tech was also contracted to conduct a field survey for the federally endangered Cumberland Bean Pearly Mussel (*Villosa trabalis*) on the lower Laurel Fork (see attached field survey map), one of five proposed reservoir sites (see attached project location map).

## **II. METHODS**

### *A. Literature Search*

A literature search identifying previous studies concerning rare species in Jackson County, Kentucky was conducted by compiling a list of published literature and technical reports and communicating with biologists that have conducted field studies in this region. Primary sources were reviewed for detailed information concerning rare species in Jackson County. In addition, data from the KSNPC provided a comprehensive list of records of rare plants and animals for Jackson County. This data included detailed information about these elements such as exact locations, date discovered or last observed, population size, and source of information.

### *B. Cumberland Bean Pearly Mussel Field Survey*

A field survey for the federally endangered Cumberland Bean Pearly Mussel in Laurel Fork was conducted September 17, 1998, by Eco-Tech biologists James Kiser, Gary Libby, and Robert Kiser. Approximately 1.3 miles of stream bed were surveyed using viewing buckets and snorkeling gear to locate live mussels, and by searching for muskrat middens and dead shells along the shores. Other freshwater unionids encountered in the survey are reported herein, but the primary focus was to

determine whether the Cumberland Bean Pearly Mussel was extant in the area of the proposed reservoir site on the Laurel Fork (see attached project location map), a tributary of the Rockcastle River in the Cumberland River drainage.

### III. RESULTS AND DISCUSSION

#### A. Literature Search

The attached bibliography contains literature sources identified during this search. Table 1 lists all state and federally listed species reported from Jackson County, Kentucky, based on information from these sources and the KSNPC data. These elements are discussed in detail following Table 1. Table 2 list elements that have been reported within or directly adjacent to the five proposed reservoir sites (see project location map).

**Table 1.** Federal and state listed rare plants, animals, and plant communities reported in Jackson County, Kentucky (KSNPC 1998 and other pertinent literature and communication).

Species	State Status	Federal Status
PLANTS		
<i>Ageratina luciae-brauniae</i> (Lucy Braun's White Snakeroot)	Special Concern	
<i>Calopogon tuberosus</i> (Grass Pink)	Endangered	
<i>Castilleja coccinea</i> (Scarlet Indian Paintbrush)	Endangered	
<i>Cypripedium kentuckiense</i> (Kentucky Lady's-Slipper)	Special Concern	
<i>Dryopteris carthusiana</i> (Spinulose Wood Fern)	Special Concern	
<i>Lilium philadelphicum</i> (Wood Lily)	Threatened	
<i>Liparis loeselii</i> (Loesel's Twayblade)	Threatened	
<i>Paxistima canbyi</i> (Canby's Mountain-Lover)	Threatened	
<i>Saxifraga micranthidifolia</i> (Lettuce-Leaf Saxifrage)	Endangered	
<i>Spiranthes lucida</i> (Shining Ladies' -Tresses)	Threatened	

<i>Taxus canadensis</i> (Canadian Yew)	Threatened	
<i>Trifolium stoloniferum</i> (Running Buffalo Clover)	Endangered	Endangered
<i>Vallisneria americana</i> (Eel-Grass)	Special Concern	
BIVALVES		
<i>Alasmidonta atropurpurea</i> (Cumberland Elktoe)	Endangered	Endangered
<i>Alasmidonta marginata</i> (Elktoe)	Threatened	
<i>Pegias fabula</i> (Little-Wing Pearly Mussel)	Endangered	Endangered
<i>Pleurobema oviforme</i> (Tennessee Clubshell)	Endangered	
<i>Ptychobranthus subtentum</i> (Fluted Kidneyshell)	Threatened	
<i>Toxolasma lividus</i> (Purple Lilliput)	Endangered	
<i>Villosa lienosa</i> (Little Spectaclecase)	Special Concern	
<i>Villosa trabalis</i> (Cumberland Bean)	Endangered	Endangered
INSECTS		
<i>Ophiogomphus howei</i> (Pygmy Snaketail)	Special Concern	
FISHES		
<i>Etheostoma cinereum</i> (Ashy Darter)	Special Concern	
<i>Percina squamata</i> (Olive Darter)	Endangered	
BIRDS		
<i>Ammodramus henslowii</i> (Henslow's Sparrow)	Special Concern	
MAMMALS		
<i>Corynorhinus rafinesquii</i> (Rafinesque's Big-Eared Bat)	Threatened	
<i>Corynorhinus townsendii virginianus</i> (Virginia Big-Eared Bat)	Endangered	Endangered
<i>Myotis leibii</i> (Eastern Small-Footed Myotis)	Endangered	

<i>Myotis sodalis</i> (Indiana Myotis)	Endangered	Endangered
<i>Ursus americanus</i> (Black Bear)	Special Concern	
COMMUNITIES*		
Acidic Sub-Xeric Forest	not ranked	
Appalachian Mesophytic Forest	not ranked	
Appalachian Sub-Xeric Forest	not ranked	
Hemlock Mixed Forest	not ranked	

\* High quality examples of natural plant communities are monitored by KSNPC. While these communities are significant natural resources, they are not ranked (like plants and animals) by state or federal agencies.

The above list includes all state and federally listed species (including former federal candidate species). Below are brief descriptions of critical habitats for each species, other pertinent information, and a statement regarding the likelihood of these species to inhabit the proposed reservoir sites. Rarity status is as follows: KSNPC = Kentucky State Nature Preserves Commission, these are state listed elements; USESA = United States Endangered Species Act, these are federally listed elements.

## PLANTS

*Ageratina luciae-brauniae* (Lucy Braun's White Snakeroot). KSNPC Special Concern. This delicate, white composite (Asteraceae) occurs in moist, sandstone rockshelters, mostly behind the dripline. This species is primarily restricted to the Cliff Section of Kentucky and Tennessee. In Kentucky, Lucy Braun's white snakeroot is largely concentrated in more rugged sections of the lower Rockcastle River drainage, Cumberland River below the Falls, the Big South Fork and Rock Creek (west). Except for one site each in Jackson and Wolfe counties, the northern limit appears to be in the lower Rockcastle River drainage (Campbell et al. 1991a, 1994). The Jackson County record is located along a pronounced cliffline above lower Horse Lick Creek in Jackson County. Of the five proposed reservoir sites (see attached project location map), only South Fork Station Camp Creek has good potential habitat for this species. Also, there is some fair habitat at the Laurel Fork and War Fork sites.

*Calopogon tuberosus* (Grass Pink). KSNPC Endangered. This spectacular orchid (Orchidaceae) is found in the dry, sandy soil of oak and oak-pine woodlands on ridgetops as well as wet open areas in streamheads. In Kentucky, this widespread eastern species is known only from seasonally wet, acid soil, generally in diverse native grassy vegetation, within the Knobs Region, Cliff Section and the Cumberland Mountains (Campbell et al. 1994). This species was formerly reported from 12 counties (Bath, Bell, Boyle, Edmonson, Jackson, Letcher, Lincoln, McCreary, Powell, Rowan, Warren, Wolfe)

according to Campbell (n.d.) and Medley (1993). Prior to recent reports from Whitley (Libby et al. 1997) and Pulaski counties (KSNPC 1998), grass pink had not been seen in Kentucky since the early 1980s (Campbell n.d., Medley 1993). Due to the variety of habitats in which species is found, some potential habitat is present at all proposed sites.

*Castilleja coccinea* (Scarlet Indian Paintbrush). KSNPC Endangered. This scarlet bracteal leaved figwort (Scrophulariaceae) inhabits damp, open sandy or rocky places in meadows and woodland edges, usually on south-facing limestone slopes. Before the recent discovery of this species in Jackson County (KSNPC 1998) it had been reported from six Kentucky counties (Carter, Christian, Larue, Leslie, Lewis, Warren) (Medley 1993). The continued existence of this species in Kentucky is uncertain as several of the previously known populations are no longer extant. This species could be found at any of the proposed sites.

*Cypripedium kentuckiense* (Kentucky Lady's-Slipper). KSNPC Special Concern. This pale-flowered lady's-slipper orchid grows in mesophytic forests on annually inundated floodplains of mid-sized or (rarely) large streams in sandy alluvium. This southern species has a center of distribution in the Cliff Section of Kentucky, mostly on somewhat sandy floodplains along a few of the larger streams (Campbell et al. 1991a). Medley (1993) lists 12 Kentucky counties from which this species has been documented (Breathitt, Carter, Elliott, Estill, Knox, Laurel, Lewis, McCreary, Menifee, Owsley, Pulaski, Rowan). The Jackson County record from along Pond Creek near Peoples was not listed by Medley (1993). This species is likely more widespread in eastern Kentucky and while it could be present at any of the proposed sites, Sturgeon Creek and Travis Creek have the best potential habitat for this rare orchid.

*Dryopteris carthusiana* (Spinulose Wood Fern). KSNPC Special Concern. This lime-green, northern (circumboreal), fern (Aspleniaceae) occurs in mesophytic forests and low, wet acidic or calcareous woods (KSNPC 1998, G. Libby, unpublished data). In Kentucky, it has been reported from 15 counties (Bell, Carter, Estill, Hickman, Jackson, Jefferson, Kenton, Laurel, Lewis, Madison, Muhlenberg, Oldham, Rockcastle, Rowan, Shelby) (Campbell n.d., Cranfill 1980, Medley 1993). The characteristic features which distinguish this fern from the more ubiquitous *Dryopteris intermedia* (Fancy Wood Fern) are somewhat confusing. The triploid hybrid of these two diploid species (*Dryopteris x triploidea*) is found wherever the parents occur together (Cranfill 1980, G. Libby, unpublished data). This fern is much more common than previously thought. Spinulose wood fern is known from the War Fork site and may occur at the other four sites as well.

*Lilium philadelphicum* (Wood Lily). KSNPC Threatened. This vivid, upright lily (Liliaceae) grows in dry thickets, open woods and clearings. In Kentucky, this species is known only along the Cliff Section, as the Appalachian variety *philadelphicum* (Campbell et al. 1991a). This species has been documented from 10 Kentucky counties (Bath, Carter, Jackson, Laurel, McCreary, Pulaski, Rockcastle, Rowan, Whitley, Wolfe) (Campbell n.d., Medley 1993). Several known populations of this species have disappeared or declined in the past 10-30 years (Campbell et al. 1994). Many of the known sites are within 20 feet of open roadsides or other rights-of-way. This species was likely more common in areas that were kept open by natural fires. In addition to fire suppression, the digging or plants for gardens may have contributed to its decline (Campbell et al. 1991b). Potential habitat for this species exists at all of the proposed sites.

*Liparis loeselii* (Loesel's Twayblade). KSNPC Threatened. This small orchid inhabits bogs, seeps, peaty meadows, damp thickets, or mesic slopes, and has been found on strip mines. This species has been reported from seven Kentucky counties (Bell, Clark, Harlan, Jackson, Knott, Pike, Powell) (KSNPC 1998, Medley 1993, R. Thompson, personal communication). This species could occur at any of the proposed sites.

*Paxistima canbyi* (Canby's Mountain-Lover) KSNPC Threatened. This diminutive shrub (Celastraceae) has been found on calcareous or calcareous shale rocks and slopes and rocky woods in the mountains, usually above major streams. Canby's mountain-lover is an evergreen perennial that most commonly occurs on rock exposures and dry forests at upper elevations (White 1996). In Kentucky, this largely Appalachian species is known from a few scattered sites on limestone cliffs, mostly along the western edge of the Cliff Section (Campbell et al. 1991a). It has been reported from nine Kentucky counties (Barren, Carter, Estill, Jackson, Jessamine, McCreary, Powell, Pulaski, Wayne) (Medley 1993, White 1996). While there is potential habitat for this species near all of the proposed reservoir sites, Canby's mountain-lover occurs on ridgetops that would not be inundated by the construction of a reservoir. In fact, two of the 17 populations in Kentucky overlook Lake Cumberland.

*Saxifraga micranthidifolia* (Lettuce-Leaf Saxifrage). KSNPC Endangered. This rosette-forming saxifrage (Saxifragaceae) occurs along brooks, on wet rocks and seeping streambanks. This species has been reported from four Kentucky counties (Harlan, Jackson, Letcher, McCreary) (Campbell n.d., KSNPC 1998, Medley 1993, J. Kiser, unpublished data). Potential habitat for this species is present at all five sites.

*Spiranthes lucida* (Shining Ladies'-Tresses). KSNPC Threatened. This small orchid grows in damp woods, marshes, wet shores, and in wet disturbed areas such as pastures. In Kentucky, this northern species is known only from a few limestone streambanks along the western edge of the Cliff Section (Campbell et al. 1991a). However, a recent discovery is from the Bluegrass Region in Clark County, Kentucky (R. Thompson, personal communication). Shining ladies'-tresses has been reported from seven Kentucky counties (Clark, Estill, Jackson, McCreary, Menifee, Wayne, Wolfe) (Medley 1993, R. Thompson, personal communication). Several sites for this species occur in the proposed South Fork Station Camp Creek reservoir site. This species could be present at the other proposed sites as well.

*Taxus canadensis* (Canadian Yew). KSNPC Threatened. In Kentucky, this evergreen shrub (Taxaceae) is found on cool, mesic streambanks and bases of limestone bluffs. This northern species is known from eight general localities along low north-facing limestone cliffs in ravines of the Cliff Section, mostly near cave entrances. Canadian yew has been documented from seven Kentucky counties (Carter, Jackson, Lee, Menifee, Pulaski, Rowan, Wolfe) (Medley 1993). It is known in the Station Camp Creek drainage, with at least five distinct patches along War Fork, and two smaller patches along South Fork (Campbell et al. 1991a). Canadian yew is known in the South Fork Station Camp Creek proposed reservoir site and likely occurs at the War Fork site. It may occur at the Travis Creek site, but is unlikely to occur at the Sturgeon Creek or Laurel Fork proposed reservoir sites.

*Trifolium stoloniferum* (Running Buffalo Clover). KSNPC Threatened, USESA Endangered. When running buffalo clover was proposed for listing as an endangered species on March 10, 1986, it was only extant at two sites in West Virginia (Bartgis 1985, USFWS 1986). Subsequently, this species was listed as federally endangered on June 5, 1987 (USFWS 1987). Since that time remnant populations have been found in several other states within the historical range. Running buffalo clover, a member of the pea family (Fabaceae), is one of four species of clover that are native to the eastern United States. Until the mid-1800's this clover ranged from eastern Kansas to West Virginia and was apparently abundant in certain locations, such as the Bluegrass Region of Kentucky. It is currently known only from scattered remnant populations. The preferred habitats for running buffalo clover are old trails, traces, and roads; grazed bottomlands, low moist forests, successional areas in mesic forests, streambanks, lawns, shoals, and cemeteries with native vegetation, with well-drained and mesic soils and filtered to partial light (Kentucky State Nature Preserves Commission [KSNPC] 1998). What all these different habitats have in common is moderate, periodic disturbance such as light grazing, animal trails, or even occasional mowing. Running buffalo clover is a perennial, forming runners or stolons that allows it to spread and form new plants. It also spreads by seeds. Flowering occurs from April to June and the seed heads are visible until August. It has a pair of leaves on the flower stalk, which distinguishes it from most other species of clover. Running buffalo clover occurs in West Virginia, Kentucky, Ohio, Indiana, and Missouri. In Kentucky, it occurs primarily in the Bluegrass Region. Running buffalo clover is currently known from twelve Kentucky counties (Boone, Bourbon, Clark, Fayette, Harrison, Jackson, Jefferson, Jessamine, Kenton, Madison, Nelson, Woodford). The recent discovery in Jackson County is from along Little Clover Creek near Eglon (KSNPC 1998). This species could occur at any of the proposed reservoir sites.

*Vallisneria americana* (Eel-Grass). KSNPC Special Concern. This submerged, grass-like plant (Hydrocharitaceae) is found in shallow and quiet waters and shores. In Kentucky, this widespread eastern species has been reported from five counties [Bracken and Jefferson counties (in the Ohio River), McCreary and Wayne counties (in the Little South Fork), and Jackson County (in Horse Lick Creek)] (Beal and Thieret 1986, KSNPC 1998, Medley 1993). This species may be declining as a result of water pollution from strip-mining in Kentucky (Campbell et al. 1994). Beal and Thieret (1986) stated that "undoubtedly it was more common in colonial and pre-colonial days." It is unlikely that this species occurs at any of the proposed reservoir sites, with the exception of South Fork Station Camp Creek which has some good habitat for this rare submerged plant due to the size of the stream.

## BIVALVES

*Alasmidonta atropurpurea* (Cumberland Elktoe). KSNPC Endangered, USESA Endangered. This native unionid is a Cumberlandian species that inhabits medium sized streams of the upper Cumberland River. Call and Parmalee (1981), noted the habitat for this species as being streams with a substrate of sand, and pebbles, mixed among cobble and boulders in shallow pools and runs where stream current is very slow. According to Cicerello et al. (1991), this species is known to be locally common in Marsh Creek, and rare in Rock Creek, both of which are in McCreary County. This species was also reported from Horse Lick Creek, Jackson County by Ahlstedt (1986), but this record probably represents a misidentification. According to KSNPC (1998), no sites are listed for the Cumberland elktoe from any of the five potential reservoir sites in Jackson County, Kentucky. This

species is very unlikely to occur in the Laurel Fork site and, as it is a Cumberlandian species, it would not inhabit the other four sites which are in the Kentucky River drainage.

*Alasmidonta marginata* (Elktoe). KSNPC Threatened. The elktoe inhabits medium and large sized streams, but it is more suited for smaller streams (Parmalee 1967). It usually inhabits sections of the stream that have good water current, several inches to two feet of water, and a sand or gravel substrate (Parmalee 1967). According to Williams et al. (1993), the elktoe ranges from northeastern United States and Canada, westward to North Dakota, south into Alabama, and eastward to Virginia. This species is sporadic and rare in the upper Cumberland River and locally common in the Licking and Kentucky rivers (Cicerello et al. 1996). The elktoe has been documented from eight locations in Horse Lick Creek in Jackson County (KSNPC 1998). It is very unlikely to occur in any of the proposed lake sites.

*Pegias fabula* (Little-Wing Pearly Mussel). KSNPC Endangered, USESA Endangered. This extremely small mussel was listed as an endangered species without critical habitat on November 14, 1988 (USFWS 1989). According to Williams et al. (1993), this rare unionid historically occurred in Alabama, Kentucky, North Carolina, Tennessee, and Virginia. This Cumberlandian species is known from moderate to high gradient, small to medium sized streams of the Cumberland and Tennessee Rivers, which contain cool water with low turbidity (Bogan and Parmalee 1983, Ahlstedt 1986). In Kentucky, the little-wing pearly mussel has been documented from several microhabitats of riverine systems, which includes lying on top of substrate in riffles of the Rockcastle River (Blankenship 1971), partially buried on top or within substrate between a long pool and riffle in the Little South Fork Cumberland River (Starnes and Starnes 1980), and buried in gravel or underneath large rocks in Horse Lick Creek (DiStefano 1984). As cited in Cicerello et al. (1991), this species is known to occur in Horse Lick Creek, Jackson and Rockcastle counties (DiStefano 1984); Kennedy Creek, Wayne County; Little South Fork Cumberland River, McCreary and Wayne counties (Starnes and Starnes 1980, Starnes and Bogan 1982); Big South Fork Cumberland River, McCreary County (Ahlstedt 1986); Buck Creek, Pulaski County (Stanesbery 1976); and Whippoorwill Creek, Logan County. According to Cicerello (1992), only one site for the little-wing pearly mussel is known from the mainstem of Middle Fork Rockcastle River. Fifteen locations of this rare unionid have been documented from Horse Lick Creek (KSNPC 1998). According to KSNPC (1998), the little-wing pearly mussel is not known from any of the five potential reservoir sites in Jackson County, Kentucky. This species is unlikely to occur in the Laurel Fork site and, as it is a Cumberlandian species, it would not inhabit the other four sites which are in the Kentucky River drainage.

*Pleurobema oviforme* (Tennessee Clubshell). KSNPC Endangered. This native unionid is a Cumberlandian species that inhabits small to medium streams. According to Williams et al. (1993), the Tennessee clubshell is known from streams in Alabama, Kentucky, North Carolina, Tennessee, and Virginia. In Kentucky, this species is known from Roundstone Creek, Horse Lick Creek, Indian Creek, Laurel and Middle Forks of the Rockcastle River, Big and Little South Forks of the Cumberland River, Kennedy Creek, Buck Creek, and Whippoorwill Creek (Cicerello et al. 1991). This mussel is currently known to inhabit Horse Lick Creek, Laurel Fork and Middle Fork of the Rockcastle River (KSNPC 1998). This species may occur at the Laurel Fork site. However, as it is a Cumberlandian species, it would not inhabit the other four sites which are in the Kentucky River drainage.

*Ptychobranthus subtentum* (Fluted Kidneyshell). KSNPC Threatened. This Cumberlandian mussel apparently prefers smaller streams and rivers where it occupies clean swept rubble, gravel, and sand substrates in shallow riffles and shoals with moderate to swift current (Ahlstedt 1984, Bogan and Parmalee 1983). It is sometimes found buried along sides of boulders and never occurs in standing pools or slack water. Starnes and Bogan (1982) reported this species to be ubiquitous in the Little South Fork (Kentucky) in riffles four to 10 inches deep in all but the swiftest current. The fluted kidneyshell is known from Horse Lick Creek (DiStefano 1984), and Middle Fork Rockcastle River (Ahlstedt 1986) in Jackson County, Kentucky. This mussel is not currently known from any of the five potential reservoir sites. It may occur at the Laurel Fork site. However, as it is a Cumberlandian species, it would not inhabit the other four sites which are in the Kentucky River drainage.

*Toxolasma lividus* (Purple Lilliput). KSNPC Endangered. The genus *Toxolasma* is a group of small unionids that inhabit gravel substrate in lakes and small to medium streams (Cummings and Mayer 1992). According to Williams et al. (1993), the purple lilliput ranges from Minnesota and Ohio in the north, southward into Alabama, east from Virginia, and westward into Oklahoma. In Kentucky, this small mussel is known from the Ohio, upper Cumberland (below the falls), Green, and Salt rivers (Campbell et al. 1991a). The purple lilliput is known from Horse Lick Creek (DiStefano 1984), Middle Fork Rockcastle River (Thompson 1985), and Rockcastle River (KSNPC 1998) in Jackson County, Kentucky. This mussel is not currently known from any of the five potential reservoir sites. It is unlikely that this species occurs at any of the proposed reservoir sites.

*Villosa lienosa* (Little Spectaclecase). KSNPC Special Concern. The little spectaclecase is a wide ranging species that inhabits sand and gravel substrate within small to medium sized streams (Cummings and Mayer 1992). According to Williams et al. (1993), it ranges in distribution from West Virginia in the northeast, southward into Florida, westward into Texas and Oklahoma, and northward into Ohio, Illinois, and Indiana. This native mussel is distributed almost statewide, and is known from most major river drainages in eastern Kentucky, but is extremely rare within the Cumberland River drainage (Campbell et al. 1991). The little spectaclecase has been documented from the Rockcastle River, Station Camp Creek, and Sturgeon Creek (KSNPC 1998). Suitable habitat for this species is present at all of the proposed lake sites.

*Villosa trabalis* (Cumberland Bean). KSNPC Endangered, USESA Endangered. The Cumberland bean is commonly known as the Cumberland bean pearly mussel, and since June 1976 has been a federally endangered species (USFWS 1984). This Cumberlandian species inhabits small and medium streams with clean, fast flowing water and a substrate composed of firm gravel, rubble, and sand (USFWS 1984). The Cumberland bean pearly mussel has a small range, that includes the Cumberland and Tennessee River drainages in the states of Alabama, Kentucky, Tennessee, and Virginia (USFWS 1984, Williams et al. 1993). According to Cicerello et al. (1991), the Cumberland bean pearly mussel is rare in the upper Cumberland River (below the falls) in Kentucky, and is known to still persist in Buck Creek, Pulaski County; Rockcastle River drainage, Jackson, Laurel, Pulaski, and Rockcastle counties; and the Big and Little South Forks Cumberland River, McCreary and Wayne counties. According to KSNPC (1998) and the present study, this rare mussel is known from two sites within the Laurel Fork drainage. As this is a Cumberlandian species, it would not occur at any of the other four proposed sites which are located in the Kentucky River drainage.

## INSECTS

*Ophiogomphus howei* (Pygmy Snaketail). KSNPC Special Concern. The aquatic larvae of this dragonfly (Odonata: Gomphidae) is known in Kentucky from the Middle Fork Kentucky River, South Fork Rockcastle River, and Rockcastle River (Schweitzer 1989). It inhabits sand and gravel in swiftly flowing, unpolluted and undammed rivers (KSNPC 1998). Apparently, the pigmy snaketail was more common and widespread, but impoundments and a decline in water quality has caused a range-wide decline in populations (Schweitzer 1989). According to KSNPC (1998), this dragonfly is not known from any of the five potential reservoir sites. This species could occur at any of the four reservoir sites.

## FISHES

*Etheostoma cinereum* (Ashy Darter). KSNPC Special Concern. This darter inhabits large and medium size streams with little current, and a substrate of gravel or cobble (Kuehne and Barbour 1983). The ashy darter has been captured in rivers from above and below riffles, and in areas where water willow (*Justicia americana*) is abundant (Kuehne and Barbour 1983). According to Etnier and Starnes (1993), this darter historically inhabited the Cumberland and Tennessee River drainages in Alabama, Georgia, Kentucky, Tennessee, and Virginia. In Kentucky, this darter is known from the Rockcastle River, Rockcastle and Laurel counties; Little South Fork Cumberland River, McCreary County; Red River, Logan County; Buck Creek, Pulaski County; and Big South Fork Cumberland River (Burr and Warren 1986). The ashy darter is known from several sites on Horse Lick Creek and a few sites on the Middle Fork Rockcastle River, approximately five miles downstream from Laurel Fork (KSNPC 1998). As this species has not been documented in the Kentucky River drainage, it would not inhabit any of the proposed sites except possibly Laurel Fork (which is in the Cumberland River drainage).

*Percina squamata* (Olive Darter). KSNPC Endangered. This darter prefers upland streams and rivers with high gradient chutes and deep riffles composed of cobble and boulders (Burr and Warren 1986, Etnier and Starnes 1993). It is occasionally found in the lower reaches of clean tributaries to rivers (Kuehne and Barbour 1983, Page 1983, Burr and Warren 1986). According to Page and Burr (1991), the olive darter range is restricted to the middle Cumberland River and upper Tennessee River drainages in Kentucky, Tennessee, North Carolina, and Georgia. In Kentucky, this fish is considered to be sporadic, rare, and known to inhabit only the Rockcastle River and Big South Fork Cumberland River (Burr and Warren 1986). This species has been documented from Horse Lick Creek and the Middle Fork Rockcastle River in Jackson County. As this species has not been documented in the Kentucky River drainage, it would not inhabit any of the proposed sites except possibly Laurel Fork (which is in the Cumberland River drainage).

## BIRDS

*Ammodramus henslowii* (Henslow's Sparrow). KSNPC Special Concern. Henslow's sparrow inhabits open fields and meadows with grass interspersed with weeds or shrubby vegetation, especially in damp or low-lying areas (KSNPC 1998). During migration and in the winter they are also found in grassy areas adjacent to pine woods or second growth woods. This sparrow is a very locally distributed summer resident across Kentucky (Palmer-Ball 1996). The species has been reported from the western Highland Rim east through central Kentucky to the northern Cumberland Plateau, but typically it is reported at not more than a few locations in any year (Palmer-Ball 1996). Moreover, numbers of birds fluctuate from year to year, perhaps in part in response to habitat availability. Henslow's sparrows typically nest on or near the ground in thick, grassy vegetation. The nest is well concealed from above by overhanging vegetation, and it is very difficult to locate. It is constructed of dead grasses and lined with finer grass and some hair (Harrison 1975). Nesting pairs sometimes occur singly, but more often the species is loosely colonial, especially in large fields of optimal habitat (Wiley and Croft 1964). There is some potential habitat for this species at all five proposed reservoir sites.

## MAMMALS

*Corynorhinus rafinesquii* (Rafinesque's Big-Eared Bat). KSNPC Threatened. Rafinesque's big-eared bats use a variety of sites for roosting, including caves, protected sites along clifflines, old mine portals, abandoned tunnels, cisterns, and old or seldom used buildings (KSNPC 1998). They also occasionally use tree cavities. This species occurs locally in much of the southeastern United States (Campbell et al. 1991a). In Kentucky, there are widespread records from 31 counties and 110 individual sites, but the total known population is only about 1400 (Campbell et al. 1991a). As currently designed, the South Fork Station Camp Creek proposed reservoir would flood an important cave for this species, as well as the closely related Virginia big-eared bat, and the Indiana myotis (both discussed below). Other caves may be indirectly impacted at this site as well. There may be winter (hibernacula) and summer (maternity, foraging) habitat for this species at any of the proposed reservoir sites.

*Corynorhinus townsendii virginianus* (Virginia Big-Eared Bat). KSNPC Endangered, USESA Endangered. The Virginia big-eared bat is a cave-dwelling species that has been seldom reported anywhere but in a cave (KSNPC 1998). The species will use small rockhouses and other protected sites along clifflines, especially for summer roosting and maternity sites. Virginia big-eared bats occur in isolated populations in eastern Kentucky, eastern West Virginia, southwestern Virginia, and northwestern North Carolina (Slone and Wethington 1998). In Kentucky, they have been documented in nine counties (Estill, Jackson, Lee, Menifee, Morgan, Powell, Rockcastle, Rowan, Wolfe). They are located in the northern Cliff Section with about 50 individual sites (Campbell et al. 1991a). Virginia big-eared bats prefer caves in karst regions (i.e., areas underlain with limestone bedrock and many caves and sinkholes) dominated by oak-hickory or beech-maple-hemlock forest. These bats hibernate near the entrances of caves in well-ventilated areas in tight clusters. In summer, maternity colonies are found in relatively warm parts of caves. This nonmigratory bat resides in caves year round. This species is known from a cave in the South Fork Station Camp Creek proposed reservoir site (see note under Rafinesque's big-eared bat and Indiana bat). There may be winter and summer habitat for this species at any of the proposed reservoir sites.

*Myotis leibii* (Eastern Small-Footed Myotis). KSNPC Endangered. Eastern small-footed myotis use a variety of habitats, including caves, mines, protected sites along clifflines, abandoned buildings, and are occasionally found roosting under rocks on the ground or on the floors of caves (KSNPC 1998). Summer habitat is currently unknown, but may be similar sites. This bat has been documented from 21 Kentucky counties. There may be winter and summer habitat for this species at the five proposed reservoir sites, although winter habitat at Sturgeon Creek is unlikely due to the lack of limestone.

*Myotis sodalis* (Indiana Myotis). KSNPC Endangered, USESA Endangered. The Indiana bat was listed as federally endangered in March 1967 (USFWS 1983). This bat hibernates in caves and abandoned mines. Most of the hibernacula with large colonies are located in Missouri, Indiana, Kentucky, Tennessee, and Arkansas (USFWS 1983). Depending on local weather Indiana bats normally enter hibernacula in October and remain there until April (LaVal et al. 1977, Hall 1962). During April the majority of the Indiana bat population will leave their hibernacula and find suitable summer habitat to form maternity colonies. Maternity colonies have been found under sloughing bark of dead and partially dead trees in upland and lowland forest (Cope et al. 1974, Gardner et al. 1991, Humphrey et al. 1977). These colonies are usually located in large-diameter, standing dead trees with direct exposure to sunlight (Callahan et al. 1997). This species is known from a cave in the South Fork Station Camp Creek proposed reservoir site (see note under Rafinesque's big-eared bat and Virginia big-eared bat). There may be winter and summer habitat for this species at any of the proposed reservoir sites, although winter habitat at Sturgeon Creek is unlikely due to the lack of limestone.

*Ursus americanus* (Black Bear). KSNPC Special Concern. Although absent from Kentucky for many years, the black bear is making a comeback in the forested mountains of the eastern part of the state. Many of the individuals reported from eastern Kentucky may have originated from reintroduction efforts that have been undertaken in western Virginia and eastern Tennessee during the past decade (D. Yancy, personal communication). In recent years, bears have been reported from numerous locations in eastern Kentucky (KSNPC 1998). Due to the large amount of undeveloped and forested areas in Jackson County, the black bear may use any of the proposed reservoir sites.

## COMMUNITIES

Acidic Sub-Xeric Forest, Appalachian Mesophytic Forest, Appalachian Sub-Xeric Forest, Hemlock Mixed Forest (not ranked). High quality examples of native plant communities are monitored by KSNPC. While these communities are not ranked by state or federal agencies, they are considered significant natural resources. Such examples of plant communities may exist at any of the five proposed reservoir sites.

The five currently proposed reservoir sites were cross referenced with the reported locations of rare plants, animals, and plants communities from the literature search to determine if any of these resources would be directly impacted by such a project. A list of these elements is included as Table

2. This does not mean that there are not other rare species within these project areas. It means that based on existing information, these resources would be impacted by reservoir construction. Site specific surveys for at least federally listed species will likely be required by the United States Fish and Wildlife Service, the federal agency responsible for regulating the Endangered Species Act.

**Table 2.** Federal and state listed rare plants, animals, and plant communities that would be impacted by five proposed reservoir sites in Jackson County, Kentucky.

<b>PROPOSED RESERVOIR SITE</b>	<b>RARE PLANTS, ANIMALS, AND PLANT COMMUNITIES THAT WOULD BE IMPACTED</b>	<b>STATE STATUS</b>	<b>FEDERAL STATUS</b>
Laurel Fork	Hemlock mixed forest Appalachian mesophytic forest Acidic sub-xeric forest <i>Villosa trabalis</i> (Cumberland Bean)	not ranked not ranked not ranked endangered	endangered
South Fork Station Camp Creek	<i>Corynorhinus rafinesquii</i> (Rafinesque's Big Eared Bat) Appalachian mesophytic forest <i>Taxus canadensis</i> (Canadian Yew) <i>Myotis sodalis</i> (Indiana Bat) <i>Corynorhinus townsendii virginianus</i> (Virginia Big-Eared Bat) <i>Villosa lienosa</i> (Little Spectaclecase) <i>Spiranthes lucida</i> (Shining Ladies'-Tresses)	threatened not ranked threatened endangered endangered special concern threatened	endangered endangered
War Fork	<i>Saxifraga micranthidifolia</i> (Lettuce-Leaf Saxifrage) <i>Dryopteris carthusiana</i> (Spinulose Wood Fern)	endangered special concern	
Travis Creek	No endangered, threatened, or special concern plants, animals, or plant communities reported.		
Sturgeon Creek	No endangered, threatened, or special concern plants, animals, or plant communities reported.		

*B. Cumberland Bean Pearly Mussel Field Survey*

The field survey for the Cumberland bean pearly mussel in the Laurel Fork resulted in live mussels, and weathered valves being found. All live Cumberland bean pearly mussels were photographed and returned to the substrate where they were found. A total of four live and two weathered Cumberland bean pearly mussels were found during field survey. The live Cumberland bean pearly mussels were partially buried in gravel and sand substrate in two to three feet of water. The survey documented

101 live mussels of six species in the section of Laurel Fork from the confluence of Indian Creek upstream to Buzzard Branch. Other freshwater mussels encountered during our field survey are listed in Table 3. All live mussels were identified and placed back into the substrate, only dead valves were retained during this survey.

**Table 3.** Freshwater unionids collected from the Laurel Fork, Jackson County, Kentucky, September 17, 1998. All live mussels were identified and returned to the substrate where they were found.

SPECIES	SITE 1	SITE 2	SITE 3
<i>Alasmidonta viridis</i>		1 (W)	
<i>Elliptio dilatata</i>	1 (L), 3 (F), 13 (W)	9 (L), 3 (F), 11 (W)	6 (L), 2 (F), 4 (W)
<i>Lampsilis cardium</i>	1 (F), 1 (W)	2 (L), 2 (W)	1 (L), 1 (W)
<i>Lampsilis fasciola</i>		1 (L)	1 (L)
<i>Ptychobranchnus fasciolaris</i>	1 (L)		
<i>Villosa iris</i>	1 (F)		
<i>Villosa taeniata</i>	5 (L), 5 (F), 12 (W)	17 (L), 3 (F), 19 (W)	2 (L), 3 (F), 3 (W)
<i>Villosa trabalis</i>		4 (L), 1 (W)	1 (L)
Total Mussels	7 (L), 9 (F), 26 (W)	33 (L), 6 (F), 34 (W)	11 (L), 5 (F), 8 (W)
Total Species	5	6	5

F = fresh dead    L=live    W = weathered dry

## **IV. SUMMARY**

### *A. Literature Search*

An extensive literature survey was conducted to identify previous studies concerning rare plants and animals in Jackson County, Kentucky (see bibliography). These sources were used to provide detailed information and discussion of these species and to evaluate their potential to occur in the five proposed reservoir sites (see attached project location map). Data from the KSNPC provided a comprehensive list of records of rare plants and animals for Jackson County. This data included detailed information about these elements such as exact locations, date discovered or last observed, population size, and source of information.

### *B. Cumberland Bean Pearly Mussel Field Survey*

A total of four live Cumberland bean pearly mussels were found at the proposed reservoir site on the Laurel Fork. These mussels were located in two to three feet, deep pools slightly above and below the proposed dam. According to Cicerello (1992), Laurel Fork is a high quality stream, which is very important to the Rockcastle River drainage because it supports a diverse assemblage of Cumberlandian mussels. Cicerello (1992) also states that Laurel Fork is an important mussel refugium for the Cumberlandian fauna, because it could serve as a site from which mussels could recolonize other streams within the Rockcastle River drainage. If the site is selected as a reservoir it would probably eliminate this unique mussel assemblage including the federally endangered Cumberland bean pearly mussel.

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